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FEASIBILITY STUDY FOR NEARLY ACCELERATOR ENERGY π^-p EXPERIMENTS IN THE 30" BUBBLE CHAMBER

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The yield of π^- in the N3 beam line[1] has been measured to find out how near accelerator energy the yield is sufficient for 30" bubble chamber operations. At 300 GeV accelerator energy we find that 290 GeV π^- operation would require 3×10^{11} protons from the accelerator to produce an average of 6-7 π^-/picture with a momentum bite of $\pm .1\%$ $\Delta p/p$.

Figure 1 shows the π^- yield per proton on target as a function of π^- momentum. Data points are shown both for the yield in Enclosure 106 and also at the bubble chamber. Note the transmission from 106 to the bubble chamber is roughly 50% above 200 GeV/c. These losses are due to small aperture magnets. Below 200 GeV/c multiple coulomb scattering contributes to the loss. All points were taken with the beam set-up in the following manner.

300 GeV/c protons were extracted from the accelerator and transported to Neuhall. The transmission from Neuhall to the target in Enclosure 100 was approximately 50%. A 4" copper target was used and the secondary beam was picked up at a production angle of 0°. The solid angle collimators in Enclosure 101 were both wide open at 10 cm. The momentum slit was set at 1 cm corresponding to a momentum bite of $\pm .1\%$ $\Delta p/p$. Collimators downstream of the momentum slit were wide open. With the exception of the momentum slit these are the conditions used to maximize the yield to the bubble chamber.

One can, of course, decrease the yield at a given momentum in

several ways. Changing from the 4" target to a 1 cm copper target decreases the yield by a factor of four, while increasing the target length to 6" does not change the yield. The yield is linear with the width of the collimators in Enclosure 101 up to a maximum width of about 6 cm vertically and 10 cm horizontally. A factor of two could be gained by opening up the momentum slit at the cost of an increased momentum bite. Finally, the yield drops if one increases the production angle to 2 mr or higher.

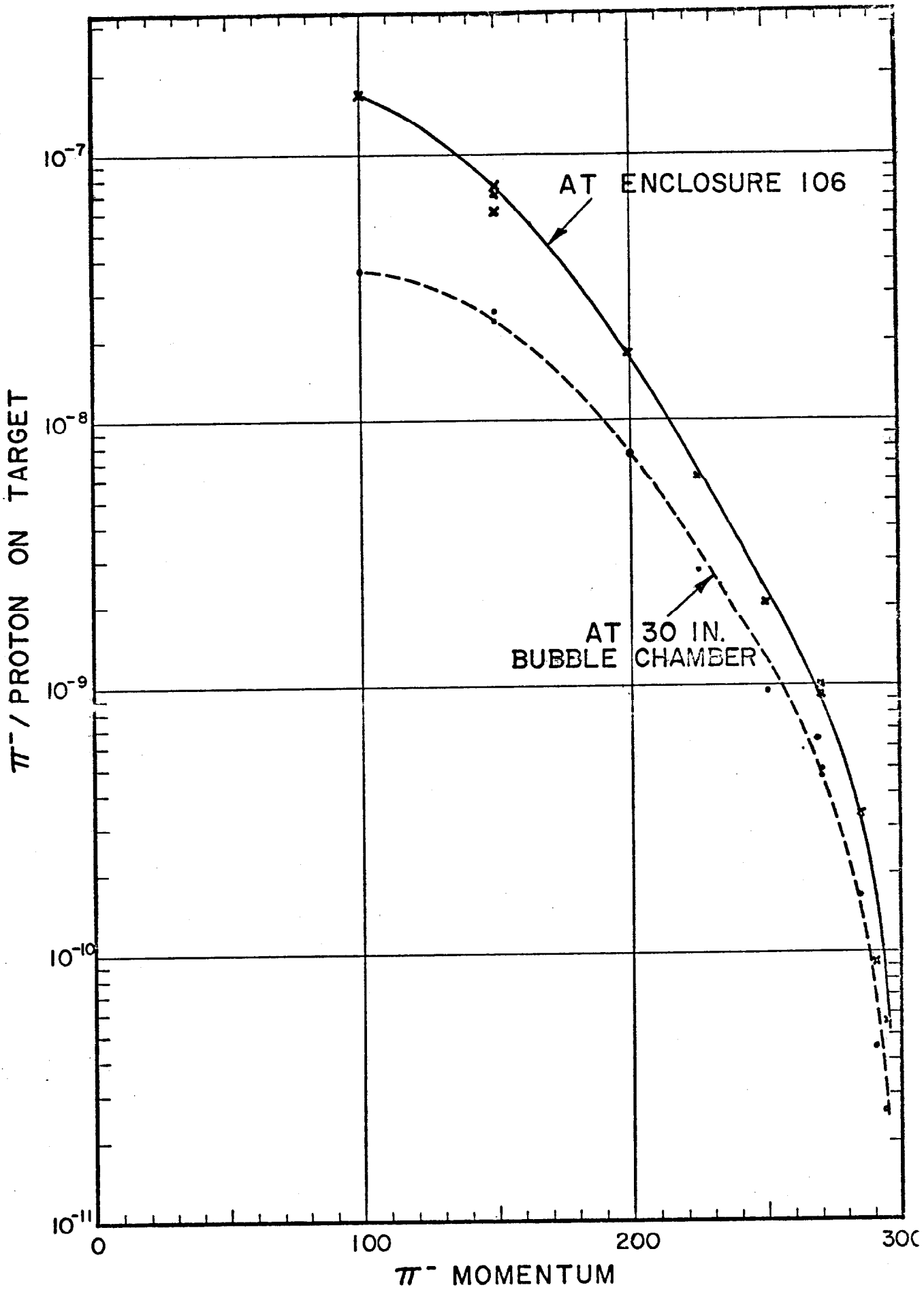
The acceptance of the beam as set-up above is ~0.3 μster as far as Enclosure 106. The yields at Enclosure 106 agree to within 20% with the yield measurements of Baker, et al[2] for π^- momentum of 100 GeV/c. The multiple data points at 150 GeV/c and 270 GeV/c π^- momentum give an indication of the reproducibility of the individual data points. Note that no corrections (decay, interaction, etc.) have been made to the data.

In conclusion, it has been shown that the N3 beam line is capable of supplying an adequate π^- beam for 30" bubble chamber experiments even up to 97% of the accelerator energy.

REFERENCES

1. TM-285

2. NAL-PUB-74/13


AT ENCLOSURE 106
AT 30 IN.
BUBBLE CHAMBER
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
π^- / PROTON ON TARGET
0
100
200
300
π^- MOMENTUM